

Pollution Prevention at Los Alamos National Laboratory

Sanitary Waste Recycling and Reduction Program Management

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The Challenge: The Laboratory must meet ambitious sanitary waste reduction and recycling goals by 2005. The waste reduction goal is currently under negotiation, but will be between 40%-75% reduction from the 1993 baseline. The Laboratory must also meet the DOE recycling goal of 45% by 2005; the current recycling rate is 41%. To meet these goals, the 775-1450 metric tons of sanitary waste must be eliminated or diverted from the Laboratory waste stream by September 30, 2005. These measures can only be met through aggressive source reduction and recycling strategies. The Green Zia Tools evaluation was conducted to serve as a preliminary plan for meeting these goals through 2005.

Routine sanitary wastes include office paper, office supplies, glass, plastic, aluminum, other metals, packaging materials, food waste, furniture, cardboard, wood and other materials. Non-routine sanitary waste includes construction and demolition debris and other materials such as brush and tree limbs. The sanitary waste reduction goal is based on routine waste only; both routine and non-routine wastes are considered in the recycling goal.

Sanitary waste characterization was conducted in 1993. Although the trends of waste generation are still similar, ongoing characterization must be conducted to “manage by fact” and develop cost effective reduction and recycling strategies to meet the 2005 goals. Disposal and recycling measurement systems are in place and are being improved to help gather accurate disposal and recycling information.

Sanitary waste source reduction programs have been put into place at the Laboratory over the past three years. These include Stop Mail, electronic filing, electronic phone books, reusable cups and catering utensils, improved document storage and double-sided printing. These programs must be more fully deployed across the Laboratory to contribute significantly to meeting the waste reduction goal.

Recycling paths have been developed for routine sanitary waste streams, including white office paper, colored paper, cardboard, and metals. Salvage operations divert furniture and other salvage materials for sale to the public. Recycling pathways have been developed for non-routine sanitary waste streams including asphalt, concrete, and clean fill. Recycling of non-routine waste streams is critical to meeting the DOE Recycling goal of 45% by 2005. Expanded recycling of routine waste streams is important to meet both the recycling goal and the sanitary waste reduction goal.

This paper will discuss how the JCNNM/ESO team used the following tools to address the issues involved with sanitary waste reduction and recycling issues:

- Determining opportunities in the current process using process maps.

- Rank ordering of the opportunities to improve the process using Pareto analysis and activity based costing.
- Determining the root cause of the selected opportunity using a cause and effect (fishbone) diagram.
- Posing a consensus problem statement for generating process alternatives.
- Generating process alternatives.
- Selecting alternatives using a forced pairs comparison.
- Developing a formal action plan for the selected alternative.

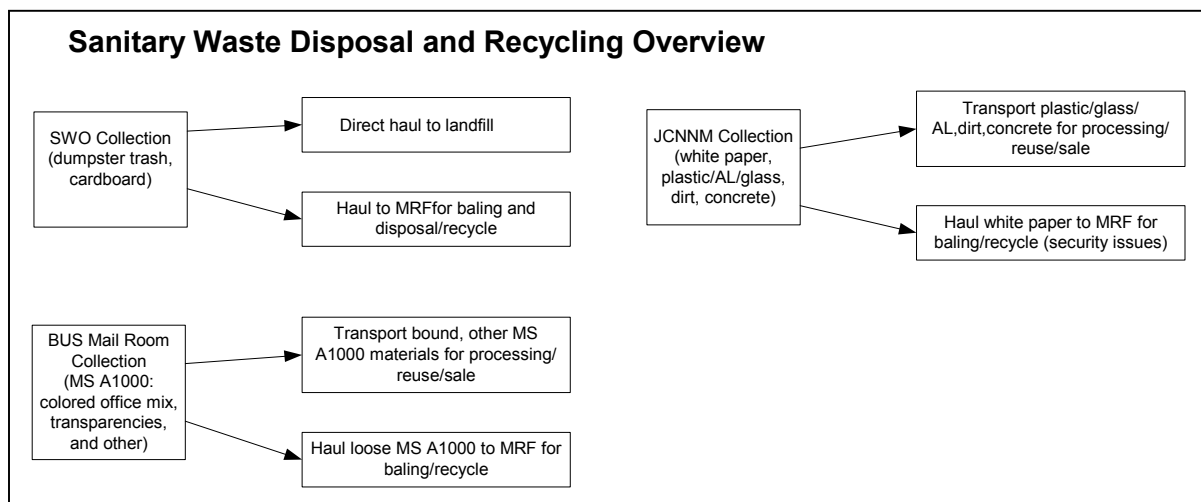
The Green Zia Team included the following participants:

- Orlando Archuleta, LANL-SWO
- Camille Bustamante, JCNNM
- Bani Chatterjee, LANL-BUS
- Patricia Gallagher, LANL-ESO
- Jim Stanton, JCNNM
- Mark Waterman, SWO
- Sonya Salzman, LANL-ESO
- Susan Voss, LANL-ESO

Process Mapping

Process maps were developed for the major sanitary waste collection, processing, disposal and recycling processes. Activity-based costing included all relevant costs for activities identified for all the mapped processes. An overview process map illustrating the waste collection, disposal and recycle flows is provided in Figure 1. Detailed maps were developed for each collection/processing and recycling process as part of overall process management but are not included in this report.

Figure 1.



- Solid Waste Operations: Routine sanitary waste is collected and processed by the Solid Waste Operations (SWO). Wastes from the cafeteria, the Health Research Laboratory, shredded paper from JCNNM, glass from TA 59 and sawdust from the JCNNM carpenter shops are hauled directly to the Los Alamos County Landfill. All other dumpster waste is processed through the Materials Recovery Facility (MRF). The MRF bales, stores and transports sanitary waste for disposal. Recyclable materials such as scrap metal and cardboard are removed from the waste stream as feasible. SWO collects and bales cardboard for recycling.
- JCNNM: JCNNM collects white office paper that is baled and stored at the MRF. Baled paper from the Laboratory is immediately pulped upon arrival at the recycling facility. These handling procedures are in place to meet security requirements. JCNNM Property Disposal also manages the non-routine waste recycling program that includes recycling of concrete, asphalt, clean fill (dirt), and brush. Concrete and asphalt is processed by Nambe and is used as base course; dirt is reused at the Los Alamos County Golf Course, and brush is chipped into mulch by the Los Alamos County landfill. JCNNM will manage the expanded aluminum, plastic and glass recycling described in this evaluation.
- Business Operations Divisions: Colored office paper, catalogs, transparencies, and other mixed office paper are collected through the Business Operations Division Mail Room under the MS A1000 program. Loose MS A1000 materials are baled at the MRF and is shipped for recycling; other MS A1000 is shipped to Nambe Recycling Facility for further processing, baling and is sent for recycling.

Rank Ordering of Opportunities

Pareto analyses were developed using waste generation by waste type information, activity-based costing information, and waste disposal and recycling information. These analyses were used to rank order opportunities for improvement. A Pareto Chart illustrating waste generation by type is shown in Figure 2; waste stream by cost is shown in Figure 3; disposal and recycle rates for FY 01 are shown in Figure 4. The waste generation rates in Figure 2 are based on waste characterization data gathered in 1993; new waste characterization studies are planned in FY 02, but the 1993 study still provides useful information on generation trends. Recycle pathways for paper, cardboard, office salvage and scrap metal have been developed; these rates are shown in Figure 3. Costs for recycling wood, glass, plastic and aluminum are estimates. No weight information for salvage materials is available. New truck scales are being installed to measure all the sanitary waste and disposal streams, including salvage.

Figure 2.

Waste Generation by Waste Type

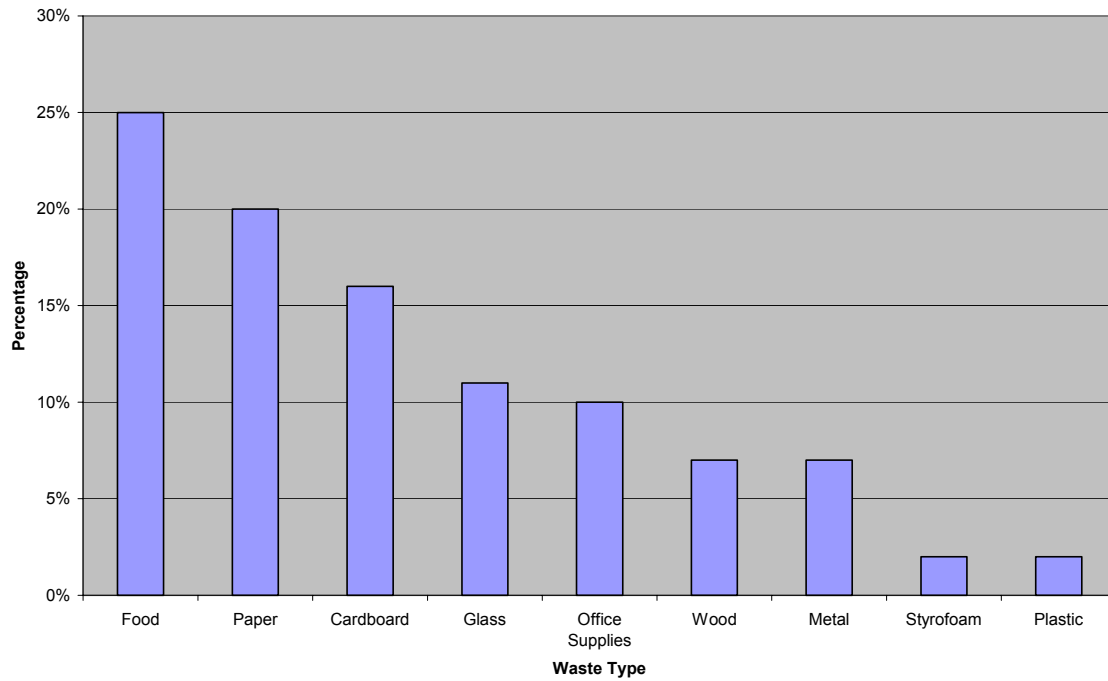


Figure 3.

Sanitary Waste Recycle and Disposal Rates

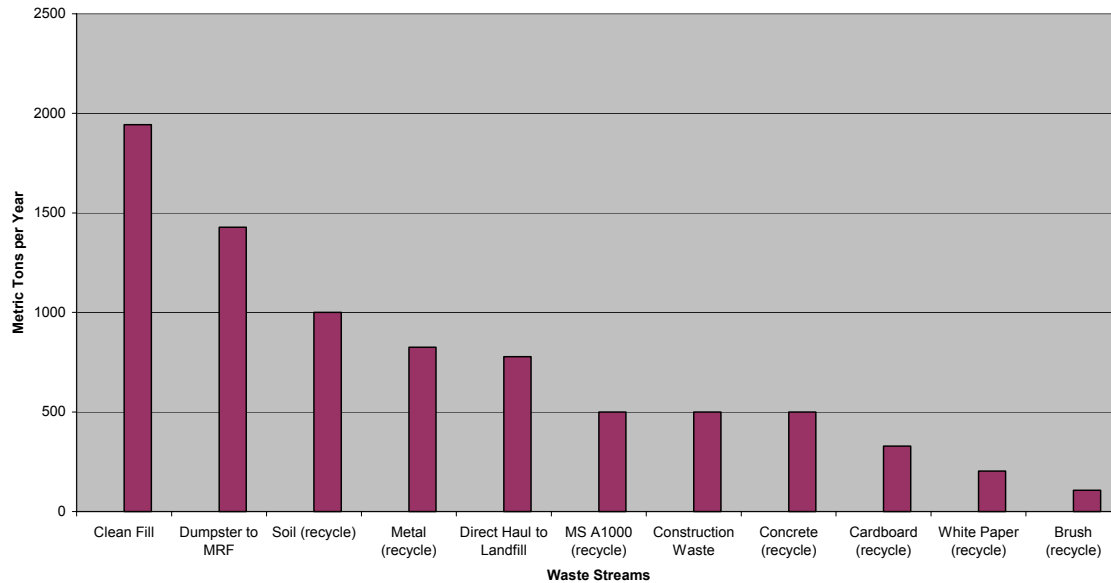
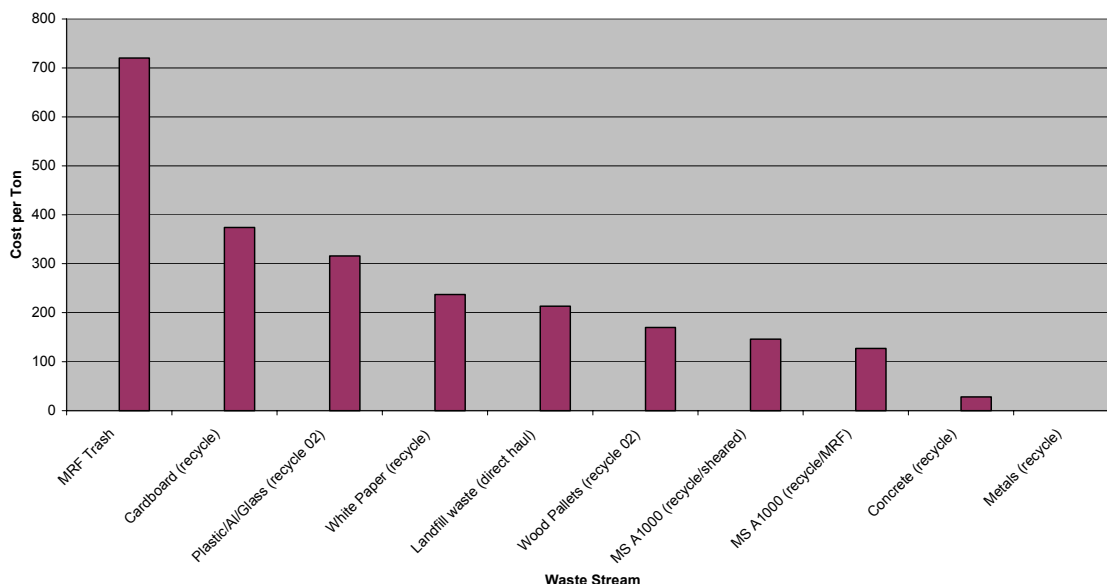


Figure 4.**Sanitary Waste Disposal and Recycling Costs**

Generator fees for waste processed through the MRF are \$720 per ton for FY 02. These fees cover collection, processing, storage and disposal costs. These fees also pay for the recycling program.

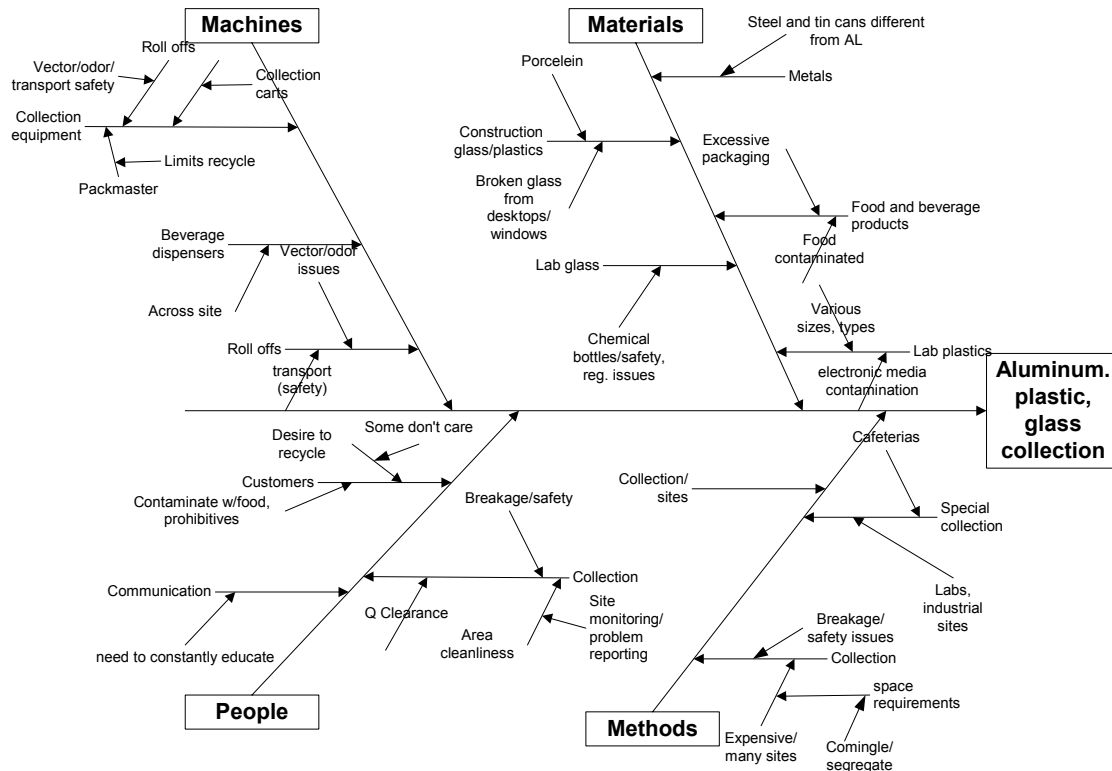
Glass, plastic, and aluminum cans, and food waste streams provide the best opportunities for expanded reduction and recycling. These streams are considered together because one collection system can capture and manage all three streams. New waste characterization is needed, but it is estimated that a glass, aluminum and plastic recycling program may eliminate 440 metric tons from the Laboratory sanitary waste stream; composting may eliminate 200 metric tons of food wastes and 420 tons of shredded paper; and wood recycling may eliminate an additional 140 tons. These combined efforts will result in waste reduction of approximately 1200 tons that will enable the Laboratory to meet the 40% reduction goal. Ongoing characterization, measurement, and tracking of the sanitary waste streams will be necessary to develop source reduction and recycling strategies to eliminate or divert the remaining 200 tons necessary to meet the 75% reduction goal. Information on salvage materials that are being diverted may significantly increase the recycling rate. As well, benchmarking the best sanitary waste reduction approaches nationally and internationally must be conducted and new strategies developed to increase source reduction opportunities at the Laboratory to meet the DOE goal.

Analysis of food waste reduction and composting is addressed in a separate Green Zia Tools evaluation. Wood recycling and reduction strategies will be addressed in a Green Zia Tools evaluation in FY 02. The remainder of this Green Zia Tools evaluation will focus on plastic, aluminum, glass recycling and reduction.

Root Cause Analysis and Statement of Problem

The team examined the issues associated with waste generation with a cause and effect diagram to identify potential causes of the problem. The diagram is presented in Figure 5.

Figure 5.



The following is a detailed list and description of the items present on the cause and effect diagram.

- Collection Equipment:** Solid waste is collected in clamshells for direct-to-landfill hauls and in clamshells; Packmasters are used for waste bound for the Materials Recovery Facility. The Packmaster compacts waste to increase hauling and collection efficiency but makes recycling collection and recovery within the solid waste stream difficult due to breakage and safety issues. Collection carts can be used to segregate recyclables but require dedicated building space, collection crews and equipment. Segregated materials collected in carts are baled on-site or sent off-site for further processing. Glass poses specific safety hazards from breakage as well as handling concerns due to weight. Collection systems should be designed to avoid double-handling of materials.

- Contamination issues: Recyclable materials are often contaminated with non-recyclable materials such as trash or prohibited wastes or the wrong recyclable material (such as newsprint mixed with glass). Glass recycling has the potential to collect non-RCRA empty chemical bottles or lab equipment that might require management as a RCRA hazardous waste. Electronic media such as CD ROMs and floppy disks contaminate the plastics recycling stream as well as pose security issues depending on information that may be stored on the media.
- Collections services and customer satisfaction: Collection service capacity must accommodate the amount of materials generated per site to assure that collection keeps up with demand. This is critical to assure customer satisfaction, good housekeeping and overall efficiency of the collection system. Special problems or larger generators may require more frequent collection or more collection capacity.
- Education and awareness: Constant customer awareness and education is necessary to sustain any recycling program. Collection areas must have clear directions to minimize contamination. Customer involvement in dealing with problems or in improving operations is essential for long-term success. Some customers want recycling regardless of cost or effort; others do not understand the value. Education campaigns and systems must assure that recycling is convenient to assure widespread and consistent participation.

Development of Alternatives

A brain-storming tool was used by the team to generate possible alternatives to the problem identified. The alternatives that resulted from this activity are as follows:

1. Develop recycle centers at each building with small collection bins for trailers.
2. Ban chemical bottle disposal: require returnables or recycle bottles
3. Develop employee awareness/education campaign for recycling and source reduction.
4. Develop reusable cup and food container campaign.
5. Develop employee focus groups to help continually improve program and as a communication mechanism.
6. Devise collection measurement system (bar code system, other?)
7. Set up Ultimate Recycling Center as part of recycling education.
8. Create FM awards to help provide incentives. Also promote source reduction.
9. Develop education campaign that illustrates what happens to lab trash that is recycled.
10. Identify Points of Contact and Waste Management Coordinators' to communicate and work issues through wastenot.
11. Develop collection system with sufficient capacity to avoid overflow and problems.
12. Assure that collection sites have adequate signage to assure good compliance with recycling requirements.

Selecting an Alternative

The team used a forced pair comparison to select alternatives that should be implemented in the near term. Many of these alternatives were similar and were combined. The final ordering was reviewed by the group and is presented below.

1. Develop recycle centers at each building with small collection bins for trailers. Develop collection system with sufficient capacity to avoid overflow and problems.
2. Identify Points of Contact and Waste Management Coordinators' to communicate and work issues through wastenot.
3. Develop employee awareness/education campaign; include a reusable cup and food container campaign. Set up Ultimate Recycling Center as part of recycling education. Develop source reduction awareness as well as recycling awareness. Develop education campaign that illustrates what happens to lab trash that is recycled.
4. Devise collection measurement system (bar code system, other?).
5. Develop employee focus groups to help continually improve program and as a communication mechanism. Create FM awards to help provide incentives.
6. Ban chemical bottle disposal: require returnables or recycle bottles.

Action Plan

The team decided to implement a recycling system for glass, plastics and aluminum. The plastics and aluminum program will be initiated first, followed by the glass-recycling program.

Action Item	Organization	Due Date	Comments
Develop source reduction education campaign and distribute reusable cup and food containers.	ESO/JCNNM	3/02	
Develop and implement a plan to collect and recycle plastic and aluminum site-wide. Includes system development and deployment, measurement and outreach and incentives.	ESO/JCNNM	11/01	
Develop and implement a plan to collect and recycle glass site-wide. Includes system development and deployment, measurement and outreach and incentives.	ESO/JCNNM	12/01	GSAF funding proposal for glass crushing equipment

